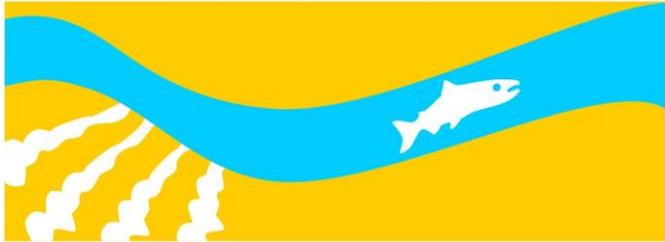


## Study 8

# Egg Survival and Emergence in Reaches 1A and 1B of the San Joaquin River

Final  
2015 Monitoring and Analysis Plan

**SAN JOAQUIN RIVER**  
RESTORATION PROGRAM





# 1.0 Egg Survival and Emergence in Reaches 1A and 1B of the San Joaquin River

## ***Theme(s):***

This study relates to the following themes: Flow management

- Spawning and incubation

## ***Related Question(s):***

- SI-013: Are river temperatures appropriate, both spatially and temporally, for spawning and incubation of spring-run Chinook salmon?
- SI-002: Where do spring- and fall-run Chinook salmon choose to spawn? What are the spawning habitat conditions in those locations?
- SI-006a: What is the percentage of fry emerging from redds in Reach 1A, and what is the condition of these emergent fry?

Questions not developed for the flow management theme to date.

## 1.1 Statement of Need

The goal of this study is to evaluate the survival to emergence, as well as the overall condition at and timing of emergence for alevins from naturally placed fall-run Chinook salmon redds in the San Joaquin River as an element of the tasks identified by the Spawning and Incubation Small Interdisciplinary Group (SIG) as important for describing the overall suitability of spawning gravel from Friant Dam to Skaggs Bridge.

## 1.2 Background

Egg survival studies were conducted in Reach 1A during 2011, 2012, and 2013 in an effort to assess egg survival in existing spawning habitat in a longitudinal gradient from Friant Dam to Highway 41. The egg survival information has been accompanied by sediment size class analysis, fine sediment accumulation, and hyporheic water quality measurements to evaluate how these variables impact survival estimates. The 2011 and 2012 studies were conducted using eyed eggs from the Feather River Fish Hatchery. In 2012, the SJRRP began a program to trap and haul adult Chinook salmon from above Hills Ferry Barrier near the Merced Confluence to Highway 99 (Reach 1B) to assess spawning site selection, movement patterns, and to conduct streamside spawning studies. In 2013, this study was paired with the trap and haul program to make more assessments

based on natural spawning success in Reaches 1A and 1B. The study was conducted using emergence traps and modified egg tubes modeled after Bernier-Bourgault incubators. The incubator tubes contained eyed and green eggs from streamside spawned fish. The 2015 plan is to continue assessing natural spawning success in Reaches 1A and 1B to gain additional understanding about the survivability and condition of embryos developing in available spawning habitat.

Fry emergence has successfully been studied in other rivers (TID/MID 1991, Bernier-Bourgault 2005 and Field-Dodgson 1983). Egg survival estimates were calculated in 2011 and 2012, but those data only describe the first step in successful reproduction for salmonids in the San Joaquin River. Assessments of alevin emergence are also important. Egg survival studies in encapsulated artificial egg tubes cannot be used to evaluate the ability of alevin to escape the hyporheic environment and emerge successfully. Given the high sand content in the system as noted in many of the background documents and ongoing studies, evaluating successful emergence is the next step in determining life cycle completion for the spawning/incubation/emergence life stages of salmon in the San Joaquin River.

Egg survival from 2011 experiments was variable both within and between sites and ranged from 13 percent to 50 percent. Highest average survival observed was at the uppermost site and lowest was in the middle of the study reach. Observed survival during 2012 was similar and ranged from 20 percent to 54 percent, with lowest and highest values at the same sites. The site with the highest survival also had the largest substrate composition, but substrate may be too large for salmon to mobilize during redd construction. The site with the lowest survival was also correlated with a high sand content. Survival ranged from 13 percent to 68 percent for eyed and 0 percent to 14 percent for green eggs during the 2013 study. These data have helped clarify the role of fine sediment in egg survival. Future efforts should focus on alevin success in naturally placed redds.

### **1.3 Anticipated Outcomes**

The study will result in several outcomes:

- Develop empirical counts of emerging alevin from natural redds in the Restoration Area.
- Develop emergence timing data and compare to known degree-day relationships for Chinook salmon.
- Assess condition of emerging alevins and compare among and across sites.
- Relate emergence timing and condition to environmental parameters at each spawning area.
- Calculate percent survival from estimated fecundity.

## 1.4 Methods

**Type of Study:** Field study

**Reach(es):** 1A and 1B

### 1.4.1 Existing Information Available

This study is modeled after the Turlock Irrigation District and Modesto Irrigation District report from 1991. Data from this study will be compared with data from the 2014 emergence study and 2011 to 2013 egg survival studies.

### 1.4.2 Timing for the Study

This study is contingent upon spawning Chinook salmon in the Restoration Area. Redds to be capped will be selected in November/December of 2014. Emergence traps will be placed two weeks before the calculated Accumulated Thermal Units (ATU).

### 1.4.3 Specific Locations

Fry emergence in naturally produced redds will be evaluated in the Restoration Area from Friant Dam to Skaggs Bridge.

### 1.4.4 Life Stage

This study will focus on egg to alevin Chinook salmon survival.

### 1.4.5 Compliance Considerations

This study is currently covered under 5-year permits acquired for the original egg survival study in the 2011 Monitoring and Analysis Plan.

### 1.4.6 Invasive Species

A Hazard Analysis and Critical Control Point (HACCP) has been developed for this activity.

### 1.4.7 Sampling

Once redds are detected, their location will be marked with a GPS unit, and date of placement recorded. The daily water temperature data collected at or near each redd will be used to estimate emergence timing based on Beachum and Murray (1990).

Approximately two weeks prior to anticipated emergence the redd will be capped with an emergence trap following the methods of TID/MID (1991). Captured alevin will be counted, measured to nearest millimeter fork length (mm FL) and a visual assessment of lifestage will be made (yolk-sac fry, button up fry, seamed fry) as well as any anomalies or obvious deformities will be noted (e.g., white spot disease, fungus, underdeveloped fins, etc.).

Up to ten paired emergence traps will be placed between Friant Dam and Skaggs Bridge. The total number will be dependent on redd placement timing and access to locations.

Data will be summarized and trends in survival and emergence will be correlated with environmental variables.

## 1.5 Deliverables and Schedule

Sampling will be conducted based on predicted egg emergence dates calculated from redd placement based on degree days. Emergence traps will be monitored throughout the emergence period. Reports will be submitted to the mid-year and end of year ATR as appropriate.

## 1.6 Budget

The total cost estimate is \$69,929 for 2015.

**Table 1-1. Proposed 2015 Budget**

<b>Task</b>	<b>Cost</b>
Staff (0.2 FTE)	\$48,818
Travel	\$3,103
Equipment	\$1,500
Subtotal	\$53,421
Overhead (30.9%)	\$16,507
<b>Total</b>	<b>\$69,929</b>

Key:  
FTE = full-time equivalent

## 1.7 Point of Contact / Agency Principal Investigator

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## 1.8 References

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